SOLUTIONS

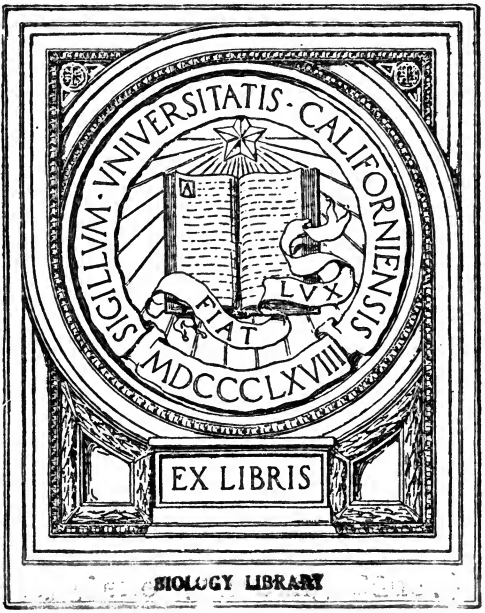
IN TEN LESSONS

A TEXT BOOK FOR NURSES

ELSIE M. SMITH

SECOND EDITION

C. V. Mosby Co. Publishers
St. Louis



SOLUTIONS

SOLUTIONS

IN TEN LESSONS

A Manual for Use in Training Schools for Nurses

BY

ELSIE M. SMITH, R.N.

Superintendent of Nurses, Fresno County Hospital, Fresno, Calif. Graduate of Milwaukee County Hospital, Wauwatosa, Wisc., 1907. Formerly Superintendent of Centerville Hospital, Centerville, Iowa; Superintendent of Nurses, Park Ave. Hospital, Denver, Colo.; Instructor, Provident Hospital, Chicago; Children's Hospital, San Francisco; Queen's Hospital, Honolulu, Hawaii; Burnett Sanitarium, Fresno, Calif.

Second Revised Edition

ST. LOUIS
C. V. MOSBY COMPANY
1922

(Printed in U. S. A.)

Press of
C. V. Mosby Company
St. Louis

DEDICATED

TO MY PUPILS

WHEREVER THEY MAY BE

PREFACE

This little volume is the result of many years of study, on the part of one who found it her duty to teach the subject of solutions in training schools for nurses without a text book to guide her.

The first outline was arranged with bits of suggestion from various sources; new rules have been formulated, and old rules revised and simplified, until every possible phase of solutions for external or internal use has been anticipated.

The author is an advocate of the Metric System because of its accuracy and simplicity, and firmly expects to see it in general use before many years.

The author hereby acknowledges assistance from Dr. Blaumgarten, Amanda Beck, and Julia Stimson, all of whom have helped to straighten out tangled

ideas on the subject of making solutions.

It is the sincere wish of the author that this little volume may reach all those who feel its need.

E. M. S.

PREFACE TO SECOND EDITION

That this little text book has taken well enough to make a second edition necessary in so short a time, proves that it was much needed, and the author appreciates the reception it has received.

The subject matter is not altered in this edition, except in the order of presentation in chapters III, IV, and V; the object being to precede the various propositions by explanations pertaining thereto.

The author wishes to dedicate this edition to her fellow instructors, and would gladly assist by further teaching hints if such be possible.

E. M. S.

CONTENTS

SOLUTIONS

LESSON I

HYPODERMIC MEDICATION
(Fractional Dosage)

Proposition 1.—To Give a Part of a Tablet

Rule.—*Put what you have over what you want to give.*

Reduce to lower terms if necessary.

The fraction thus obtained, tells what part of your original tablet you are to give.

Do *not* use less than eight (8) drops of water in which to dissolve the tablet.

Dissolve in number of drops indicated by the denominator.

Give number of drops indicated by the numerator.

Example 1.—Given tablets Morphine gr. $\frac{1}{8}$, to give gr. $\frac{1}{9}$.

$$\frac{8 \text{ (what you have)}}{9 \text{ (what you want to give)}}$$

Dissolve in 9 drops of water, and give 8 drops. You are thus giving $\frac{8}{9}$ of the whole tablet.

Example 2.—Given Strychnine gr. $\frac{1}{30}$, to give gr. $\frac{1}{40}$.

$$\frac{30 \text{ (what you have)}}{40 \text{ (what you want to give)}}$$

$\frac{30}{40}$ equals $\frac{3}{4}$. Since it is not reasonable to dissolve a tablet in only 4 drops of water, we multiply each term of the fraction by the same number, which does not alter the value of the fraction. Thus:

$$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$$

Dissolve in 12 drops and give 9.

Example 3.—Given Atropine gr. $\frac{1}{200}$, to give gr. $\frac{1}{150}$.

$$\frac{200}{150}$$ (what you have) / (what you want to give)

$\frac{200}{150}$ equals $\frac{2}{15}$ equals 1-¼ which tells us that it will take more than one tablet.

Hence, $\frac{2}{200}$ equals $\frac{1}{100}$ then

$\frac{100}{150}$ equals $\frac{10}{15}$

Dissolve 2 tablets in 15 drops of water and give 10 drops.

4.—Given Strychnine gr. $\frac{1}{60}$, to give gr. $\frac{1}{75}$.

5.—Given Pilocarpine gr. $\frac{1}{3}$, to give gr. $\frac{1}{8}$.

6.—Given Morphine gr. $\frac{1}{6}$, to give gr. $\frac{1}{32}$.

7.—Given Nitroglycerine gr. $\frac{1}{75}$, to give gr. $\frac{1}{200}$.

8.—Given Atropine gr. $\frac{1}{150}$, to give gr. $\frac{1}{100}$.

9.—Given Digitalin gr. $\frac{1}{100}$, to give gr. $\frac{1}{60}$.

10.—Given Strychnine gr. $\frac{1}{32}$, to give gr. $\frac{1}{30}$.

11.—Given Heroin gr. $\frac{1}{24}$, to give gr. $\frac{1}{10}$.

Proposition 2.—When the Drug is in a Solution

Rule.—*Form a fraction as before, and reduce to convenient terms.*

Example 1.—Given a solution of Strychnine in which 10 drops equals gr. $\frac{1}{30}$, to give gr. $\frac{1}{40}$.

$\frac{30}{40}$ equals $\frac{3}{4}$ which tells us that we are to use $\frac{3}{4}$ of 10 drops.

Since 10 is not evenly divisible by 4, we take ten drops and add to it 2 drops of water, thus giving us,

12 drops equal gr. $\frac{1}{30}$ then
$\frac{1}{4}$ of 12 equal 3 and
$\frac{3}{4}$ of 12 equal 9 drops, therefore
9 drops contain gr. $\frac{1}{40}$.

Example 2.—If gtt. x equal gr. $\frac{1}{30}$, how would you prepare to give gr. $\frac{1}{75}$?

Example 3.—Given solution in which gtt. x equal gr. ½, to give gr. ⅕.

⅖ of 10 equal 4 drops.

LESSON II

THE TWO SYSTEMS: APPROXIMATE EQUIVALENTS: SATURATION

The Common System

By the Common System we mean the system of weights and measures in common use in the United States. For the purpose of solutions we use the tables used by druggists.

APOTHECARIES' TABLE OF WEIGHTS

20 grains (gr.) make one scruple (℈).
3 scruples make one dram (ʒ).
8 drams make one ounce (℥).
12 ounces make one pound (lb.).

APOTHECARIES' TABLE OF MEASURE OR CAPACITY

60 drops (gtt.) make one fluidram (fʒ).
8 fluidrams make one fluidounce (f℥).

16 fluidounces make one pint (O).
32 fluidounces make one quart (Oij).
4 quarts make one gallon (C).

From the tables it can readily be seen that in the common system the unit of weight is 1 grain; and the unit of measure is 1 drop. In calculating new solutions or making dilutions, the chemical and solution must always be expressed in "similar terms"—similar in system as well as measure. Drams and ounces in weight can be used with drams and ounces in measure, but difficulties are apt to arise, and the author does not advise it.

Unit of Weight—1 Grain.
Unit of Measure—1 Drop.

The Metric System

The Metric System is a decimal system throughout, and very much simpler than the Common. It can readily be transposed if desired, after the required quantity has been computed. All lab-

oratories and scientific institutions in the United States are now using the Metric System because of its accuracy and simplicity.

Unit of Length—1 meter (m.), 39.37 inches.

Unit of Weight—1 gram (gm.), 15.4 grains.

Unit of Measure—1 cubic centimeter, (c.c.), 15.4 drops.

In the Common System the terms are written first and followed by quantity in Roman numerals, e.g., gtt. xv.

In the Metric System the terms are preceded by the quantity written in Arabic numerals, e.g., 5 gm.

One Cubic Centimeter of distilled water at 4 degrees centigrade weighs one gram,—hence we can say, that in substances having approximately the same density as water, one centimeter and one gram are the same. In solid or viscid substances, it is not true, because of their greater density.

TO READ—

1000 gm., (Weight of 1000 c.c. of water) one kilogram.

1 gm., One gram.

.1 gm., (One-tenth of a gram) one decigram.

.01 gm., (One one-hundredth of a gram) one centigram.

.001 gm., (One one-thousandth of a gram) one milligram.

1000 c.c., (Measure of 1000 gm. of water) one liter.

1 c.c., (One one-thousandth of a liter) one milliliter.

.1 c.c., (One-tenth of a cubic centimeter).

In actual practice, we seldom use terms other than the cubic centimeter to designate measure.

The minim belongs to the Metric System, and is the approximate equivalent of one drop.

Approximate Equivalents in the two Systems:

Common		*Metric*
1 drop (gtt.i)	equals	1 minim.
15 drops (gtt.xv)	"	1 c.c.
1 fluidram (f℥i)	"	4 c.c.
1 fluidounce (f℥i)	"	30 c.c.
1 pint (Oi)	"	500 c.c.
1 quart (Oii)	"	1000 c.c.
1 grain (gr.i)	"	.065 gm.
	(Sixty-five milligrams)	
15 grains (gr.xv)	equals	1 gm.
1 dram weight	"	4 gm.
1 ounce weight	"	30 gm.

(NOTE: If one cubic centimeter of water weighs one gram, is there any reason why 30 c.c. of water should not weigh 30 grams? Or 500 c.c. weigh 500 grams?)

Give oral practice in transposing from one System to the other.

Oral

Give metric equivalents—

15 drops	15 grains
4 fluidrams	1 grain
1 fluidounce	1 dram wgt.
30 drops	1 pound

3 fluidounces	¼ grain
15 drops	30 grains
16 ounces	60 grains
6 fluidrams	45 drops
8 fluidounces	6 ounces wgt. 45 grains

Reduce to "simpler terms:"

1. 3 pints to drams.

2. 4 quarts to cubic centimeters.

3. 2 ounces to drops.

4. 3 drams weight to grains.

5. 20 fluid ounces to cubic centimeters.

6. 3 cubic centimeters to drops.

7. 1½ pints to drams.

8. 2 quarts to ounces; to drams; to cubic centimeters.

9. 30 grams to grains; to drams (weight).

10. 8 fluidounces to cubic centimeters.

Saturation

A solution is said to be saturated, when no more of the substance in ques-

tion can be dissolved, and remain in solution when cold.

SATURATED STRENGTHS

Boric Solution	.04
Carbolic Solution	.07
Tr. Iodine	.07
Spirits of Camphor	.10
Camphor Water	.008
Salt (Stock Sol.)	.20
Formalin	.40
Bichloride of Mercury	1-16 (.0625)
Potassium Permanganate	1-16 (.0625)
Potassium Iodide (K. I.)	100%

Normal Salt Solution is .0085 per cent, and hence requires 8.5 grams of salt to each 1000 c.c. of solution.

(Give oral practice in transposing from one system to the other; also in reducing large terms of the common system to simpler terms.)

LESSON III

To Point Off in Multiplication of Decimals

Rule.—*Point off as many places in the product as there are decimal places in both terms of the problem.*

What Are the "Pure Drugs"?

Anything in a powder or crystal (unadulterated), hence 100%. Lysol, Carbolic, Cresol or Creolin, and Alcohol are considered as 100%.

Proposition 3.—To Make Percentage Solutions From a Pure Drug

Rule.—*Multiply the quantity required by the percentage desired, and the product will be the amount of "pure drug" to be taken.*

The "quantity required" should always be expressed in simple terms.

One quart may be expressed as 1000 c.c. or it may be reduced to ounces, drams, or drops. Whatever terms the quantity is expressed in, so the answer will be, and it is more comprehensible to say 12 drams than to say 1.5 ounces.

Example 1.—Make 1 qt. of 5% Carbolic solution.

1 qt. equals 32 oz. equals 256 drams.

256 drams
.05

12.80 drams of pure carbolic plus water enough to make 1 quart, makes 1 quart of 5% solution.

Or, 1000 c.c.
.05

50.00 c.c. of pure carbolic, plus water enough to make 1 quart, makes 1 quart of 5% solution.

Example 2.—Make 20 oz. of 2% Lysol solution.

20 oz. equals 160 drams
.02

3.20 drams of ly-

sol, plus water enough to make 20 ounces, makes 20 ounces of 2% solution.

Or, 20 oz. equals 600 c.c.

600 c.c.
.02

12.00 c.c. of pure lysol, plus water enough to make 600 c.c., makes 600 c.c. of 2% solution.

Example 3.—Make 2½ quarts of ½ of 1% Silver Nitrate solution.

2½ qt. equals 80 oz. equals 640 drams.

640 drams
.005

3.200 drams, weight, equal 192 grains.

Or,

2500 c.c.
.005

12.500 grams by weight of Silver Nitrate in 2½ quarts of water, will make 2½ quarts of .005 solution.

Why grams? Because one gram is the unit of weight in the metric system,

and when considering a solid substance it must be weighed.

(Compare 192 grains and 12.5 grams).

4.—Normal Salt Solution being .0085 (%), how much salt will it take to make 5 quarts?

(Work in metric and reduce to grains.)

5.—How much Milk Sugar will it take to make 12 ounces of 2% solution?

6.—How many drams of Potassium Permanganate will it take to make 3 pints of a Saturated Solution?

7.—How much Oxalic Acid will it take to make 2 quarts of a 2% solution?

(Express in gm., gr., and drams.)

8.—Tell how to make 500 c.c. of 2½% Creolin.

9.—Make 8 ounces of Saturated Boric.

10.—Tell how to make 3 ounces of Tr. Iodine.

(What is a tincture?)

LESSON IV

To Point Off in Division of Decimals

Rule.—*1st. There must be as many decimal places in the dividend as there are in the divisor. If necessary, supply the required number by adding cyphers.*

2nd. Point off as many places in the quotient as those in the dividend exceed those in the divisor.

To Find the Ratio

Rule.—*Divide the larger number by the smaller.*

If the strength of the solutions in question is expressed in proportion, use only the second numbers, e.g.,—Find the ratio between 1-20 and 1-500.

$$20\overline{)500}$$

25 equals the ratio, i.e., 1-20 is 25 times as strong as 1-500.

If the strength of the solution in question is expressed in percentage, the process is the same, careful attention being given to the rule for pointing off in division of decimals, e.g., Find the ratio between .05 and .005.

.005).05 0

10. equals the ratio, i.e., .05 is 10 times as strong as .005.

Key to Dilutions

Rule.—*Multiplying the quantity, divides the strength in the same ratio.* E.g., Take 1 oz. of 4% Boric Solution, and add to it 1 oz. of water. You will then have 2 oz. of 2% solution. The quantity has been multiplied by two, and the strength has been divided by two.

What is a Stock Solution?

Any preparation in high percentage or saturate strength, kept on hand for convenience; or any strength above that desired for use, such as 5% Carbolic,

1-500 Bichloride of Mercury, 40% Argyrol, 25% Silver Nitrate, 1-1000 Adrenalin.

Proposition 4.—To Make Percentage Solutions From a Stock Solution, When the Ratio Is a Whole Number

Rule.—*When the ratio is a whole number, divide the quantity required by the ratio. The quotient is the number of measures of Stock Solution to be taken.*

NOTE: If a very small quantity is required, reduce to drops before dividing.

Example 1.—From 25% Argyrol make 1 oz. of 5%.

Common System—

25 divided by 5 equals 5 (ratio).

1 oz. equals 8 drams.

8 drams equals 480 drops.

480 divided by 5 (ratio) equals 96 gtt.

Take 96 drops of 25% and add to it sterile water enough to make 1 ounce.

Or

Metric System—30 c.c. divided by 5 (ratio) equals 6 c.c. Take 6 c.c. of 25%, and add to it sterile water enough to make 30 c.c., or one ounce.

(Compare 96 drops and 6 c.c.)

Example 2.—Given 20% Silver Nitrate solution to make 4 drams of 2%.

Common System—

20 divided by 2 equals 10 (ratio).

4 drams equal 240 gtt.

240 divided by 10 (ratio) equals 24 gtt.

Take 24 gtt. of 20% solution and add to it water enough to make 4 drams.

Metric System—

4 drams equal 16 c.c.

16 c.c. divided by 10 (ratio) equal 1.6 c.c.

Take 1.6 c.c. (which is 24 drops) of 20% solution and add to it water enough to make 16 c.c.

Example 3.—Prepare 1 quart of .005 Formalin solution for preserving a specimen.

(Formalin is 40%.)

40 divided by ½ is 80 (ratio).

1 quart equals 1000 c.c.

1000 divided by 80 equals 12.5 c.c.

Take 12.5 c.c. of Formalin and add to it water enough to make 1000 c.c., or one quart.

4.—Given 5% Carbolic solution, make 2 qt. of .005.

5.—From 10% Silver Nitrate solution make enough 1% for a baby's eyes.

6.—Having 15% Argyrol, make 2 drams of 5%.

7.—Given Lysol 5%, make 2 qt. of .025.

8.—From Tr. Iodine, make 2 oz. of .035.

LESSON V

Proposition 5.—To Make Percentage Solutions From a Stock Solution When the Ratio is Fractional

Rule.—*Divide the quantity required by the strength you have, then multiply the quotient by the strength desired. The result represents the number of measures of stock solution to be taken.*

Example 1.—Given 10% Glucose solution to make 2 oz. of 4%.

2 oz. equals 60 c.c. (the quantity required).

60 c.c. divided by 10 (the strength desired).

.10)60.00(600 then 600 × .04 equals 24.00 c.c.

Take 24 c.c. of 10% Glucose, plus water or salt solution, enough to make 60 c.c.

NOTE.—The Stock Solutions are only a fractional part as strong as the "pure

drug,'' hence the necessity of multiplying by the strength desired. In this case it is $\frac{4}{100}$ as strong, consequently take $\frac{4}{100}$ times as much.

Example 2.—From Tr. Iodine make 5 ounces of 3%.

5 oz. equals 40 drams

40 divided by .07

```
.07)40.00(571.
    35
    ---
     50
     49
     --
      10
       7
       -
       3
```

then 571 multiplied by .03 equals 17.13 drams. Take 17 drams of Tr. Iodine, plus alcohol enough to make 40 drams.

Or,

5 oz. equals 150 c.c.

150 divided by 7% equals

```
.07)150.00(2143.
    14
    --
     10
      7
      -
      30
      28
      --
       20
```

then 2143 multiplied by .03 equals 64.29 c.c. Take 64 c.c. of Tr. Iodine, plus alcohol enough to make 150 c.c.

Example 3.—From 95% Alcohol, make 1 pint of 70%.

500 c.c. divided by 95% equals

$$
\begin{array}{r}
.95)500.00(526. \\
475 \\
\hline
250 \\
190 \\
\hline
600 \\
570 \\
\hline
\end{array}
$$

then 526 multiplied by 70% equals

$$
\begin{array}{r}
526 \\
.70 \\
\hline
368.60 \text{ c.c.}
\end{array}
$$

Take 368 c.c. of Alcohol and add water enough to make 500 c.c.

4.—From 15% Argyrol, make 2 drams of 2%.

5.—Given 30% Silver Nitrate solution, make 3 oz. of 4%.

6.—From Formalin, make 100 c.c. of 25%.

7.—Having Carbolic solution 5%, prepare 2 qt. of 2%.

8.—From Cocain solution 10%, make 1 dram of 4%.

9.—Given Argyrol 25%, make 1 oz. of 10%.

10.—Having Silver Nitrate solution, 40%, make 8 oz. of 3%.

LESSON VI

Proposition 6—To Calculate Percentage of a Solution

(a) When made from a "pure drug."

(b) When made from a stock solution.

(*a*) *When made from a "pure drug." —Divide the amount of chemical taken, by the amount of solution made. The quotient is the percentage.*

Example 1.—10½ drams of pure Lysol in 2 qt. of water, make what percentage?

2 qt. equal 64 oz. equal 512 drams.

512)10.50(.02
10 24

Ten and one-half drams of Lysol in 2 quarts of solution makes approximately 2%.

(*b*) *When made from a stock solution.—Proceed as in* (*a*), *then multiply the quotient by the percentage of the stock solution.*

Example 2.—If 10½ drams of .05 Carbolic solution be added to water enough to make 2 qts., what percentage would it be?

Dividing as before, we would get 2%.

Then .02
.05
.001 the strength of the new solution, because what we started with was only 5/100 as strong as a "pure drug."

What Does Per Cent Mean?

Per cent always refers to 100. Just as .06 (6 per cent) interest on money means that some one pays 6 cents on each dollar, or one hundred cents, so does 6% solution mean that in each 100 drops of solution, there are 6 drops of a liquid chemical.

If the chemical happens to be a powder or crystal, which has to be weighed rather than measured, then it is 6 *grains* of chemical in each 100 drops of solution.

Since the drop is the *unit* of measure and the grain the *unit* of weight, they are complementary terms in the Common System.

In speaking of percentage in terms of the Metric System, we use the unit of measure, which is the c.c., and the unit of weight, which is the gram, and then say—6% means 6 c.c. of liquid chemical in each 100 c.c. of solution, or 6 grams of dry chemical (powder or crystal) in each 100 c.c. of solution.

What Does Proportion Mean?

Our percentages could all be written as proportion, and still mean the same thing: e.g., since 5% means, in terms of the Common System, 5 drops of a liquid chemical in 100 drops of solution, we

can write it 5-100. As any proportion, it may be reduced to simpler form without changing the value.

Thus, $\frac{5)5\text{-}100}{1\text{-}20}$

Applying our rule as given in Proposition 6, we can divide 1 by 20 and get again our 5%.

In terms of the Metric System 5-100 means 5 grams of a dry substance, or 5 c.c. of a liquid substance in each 100 c.c. of solution.

Oral Problems.—

1. Give meaning of the following proportions first in terms of the Common System, then in terms of the Metric System, using both liquid and dry chemical.

1-100: 1-1000: 1-16: 1-40: 1-4000:

1-200: 1-500: 1-2500: 1-10,000: 1-5.

2. Simplify the following propositions:

20-500: 40-1200: 6-1800: 25-400.

3. Transfer the above proportions into percentage.

LESSON VII

Proposition 7.—To Make Dilutions from a Stock Solution When Expressed in Proportion

Rule.—*Divide the amount required by the ratio. The quotient will be the amount of stock solution to be taken.*

Example 1.—Given 1-32 Bichloride solution to make 2 quarts of 1-8000.

Find the ratio thus:

32)8000(250
64
160
160

Then, 250)2000 c.c.(8 c.c.
2000

Take 8 c.c. of 1-32 solution and add to it water enough to make 2000 c.c.

Example 2.—Given 1-8 Silver Nitrate solution to make 3 pints of 1-4000.

Find the ratio thus:

8)4000(500
40
00

Then 500)1500 c.c.(3 c.c.
1500

Take 3 c.c. of 1-8 solution and add to it water enough to make 1500 c.c.

3.—Given 1-16 Potassium Permanganate solution to make 500 c.c. of 1-8000.

4.—From Bichloride solution 1-500 make 3 qt. of 1-6000.

5.—From a 4% Silver Nitrate solution prepare 1 qt. of 1-1000.

6.—From Adrenalin 1-1000 make 1 c.c. of 1-3000.

7.—From Formalin prepare 2 qt. of 1-1000.

8.—From Silver Nitrate solution 10% make 1½ qt. of 1-300.

9.—From a 1-20 solution of Carbolic, make 2500 c.c. of .005 (½ of 1%).

10.—From Bichloride 1-500 make 8 oz. of 1-3000.

LESSON VIII

Proposition 8—Percentage Solutions to Give Grains

NOTE:

1% means 1 grain in 100 drops, 1-100.

5% means 5 grains in 100 drops, 5-100.

20% means 20 grains in 100 drops, 20-100.

50% means 50 grains in 100 drops, 50-100.

Since both terms of a proportion can be either multiplied or divided by the same number, and the value of the fraction is not changed—

We can simplify the above proportions thus:

5-100 equals 1-20
20-100 equals 1-5
50-100 equals 1-2

Hence, in a 1-20 solution there is 1 grain of the chemical in each 20 drops: or 1 gram of the chemical in each 20 c.c.

Rule.—*Write percentage as a proportion and simplify:*

Compute the number of drops necessary to give the dose ordered.

Example 1.—Given a solution of Camphor in oil 20%, to give 5 grains.

Since 20-100 equals 1-5, each 5 drops contain 1 grain. Multiplying both terms of the proportion by same number we have,

1-5
5

5-25. In each 25 drops there will be 5 grains.

Example 2.—Given a 10% solution of Ammonium Chloride, to give 3 grains.

Since 10-100 equals 1-10, there is 1 grain in each 10 drops, or 1 gram in each 10 c.c.

Multiplying both terms of the proportion by the same number, we have

1-10
3

3-30. In each 30 drops there are 3 gr. of Ammonium Chloride.

3.—From a 40% solution of Sodium Bromide give 10 grains.

20)40-100
2)2-5
1-2.5

Hence in each 2½ drops there is 1 grain of the chemical.

Multiplying both terms of the proportion by the same number,

1- 2.5
10

10-25.0. In each 25 drops of solution there are 10 grains of Sodium Bromide.

4.—From Tincture Camphor 10%, give 2 grains.

5.—Given a 5% solution of Potassium

Permanganate, how would you prepare a dose of 4 grains?

6.—Potassium Iodide being saturated at 100 per cent, how many drops would it take of such a solution to make 40 grains?

7.—From a 20% solution of Silver Nitrate, prepare a 3 oz. gargle containing 3 grains.

8.—From a 10% solution of Sodium Bromide prepare to give 30 grains.

LESSON IX

Proposition 9—To Give a Fraction of a Drop

Review Key to Dilutions

(See Lesson IV)

Rule.—*To one drop of the solution, add X drops of water to equal the denominator of your desired fraction, then use one drop of the new solution.*

Example 1.—To give ⅓ of a drop.

To one drop of the solution, add 2 drops of water: by so doing you have multiplied your quantity by three; hence each drop of the new solution now contains ⅓ of the original chemical, and by giving 1 drop of the new solution, you are giving ⅓ of the original drop.

Example 2.—If gtt. 1 equals gr. 1 how would you give gr. ¼?

Take 1 drop of the solution, and add to it 3 drops of water. Then, 4 drops contain gr. 1.

Give 1 drop of the new solution.

Example 3.—From a saturated solution of KI prepare for an infant ¼ gr.

KI is saturated at 100% which means 100 grains in 100 drops, hence, 1 grain in each drop.

Take 1 drop of the solution, add 3 drops of water, and give 1 drop of the new solution.

4.—From Tincture Digitalis 40% give ⅛ of a drop.

5.—From any 50% solution, prepare ¼ grain dose.

6.—Given a 100% solution, prepare a dose of ⅕ grain.

LESSON X

MISCELLANEOUS PROBLEMS

1.—Make 16 ounces of 3% soda solution. (Give answer in grains.)

2.—What percentage will you get by adding 1 ounce of 20% Silver Nitrate solution to enough water to make 1 quart?

3.—From two Bichloride tablets, each containing 7½ grains, make some 1-1000 solution. How much water will be required?

4.—From 20% Argyrol solution make two drams of 3%.

5.—From a solution of Sodium Bromide 40% give 30 grains.

6.—What percentage is 1-500?

7.—From stock solution of Potassium Permanganate 1-16 make 2½ qt. of 1-8000.

8.—From 20% Silver Nitrate solution make 2 qt. of 1-2000.

9.—From one tablet containing one-half gram, prepare some 1-1000 solution. How much water is required?

10.—From two Bichloride tablets each containing 7½ grains, make some 1-4000. How much water is required?

11.—From a Bichloride tablet containing 60 grains, make 1-2000 solution. How much water is required?

12.—How much Oxalic Acid will it take to make 3 pints of a 1-50 solution?

(Give answer in three ways—grams, grains, drams.)

13.—Make 4 quarts of ½ of 1% Creolin solution.

14.—Given a Bichloride tablet containing 15 grains, how much water would be required to make 1-10000?

15.—Given tablets of Digitalin gr. $\frac{1}{50}$, how would you give gr. $\frac{1}{75}$?

16.—Given tablets gr. $\frac{1}{15}$, to give gr. $\frac{1}{10}$?

17.—From tablets gr. $\frac{1}{40}$ give gr. $\frac{1}{30}$.

18.—From Carbolic solution 5% make 3 quarts of 2%.

19.—How much Boric powder would be required to make 3 quarts of 3% solution?

20.—From Tr. Iodine, make 2 ounces of 2%.

21.—From a 50% solution of Potassium Bromide give 20 grains.

22.—How many 7½ grain tablets will it take to make 2½ quarts of 1-1000 solution?

23.—How much Formalin will be required to make 4 quarts of a ½ of 1% solution?

24.—Make 2 quarts of 1-4000 Bichloride from a 1-32.

25.—Tell how to make 2 ounces of 2% Silver Nitrate solution from 15%.

26.—Given 25% Argyrol, tell how to make about an ounce of 2½%.

27.—Given .05 solution to make 1 quart of .005.

28.—If 10 drops equal gr. $\frac{1}{30}$, how would you give gr. $\frac{1}{150}$?

29.—Given a solution in which 10 drops equal gr. $\frac{1}{2}$, to give gr. $\frac{1}{5}$.

30.—What percentage solution would you get by dissolving 30 grains of Oxalic Acid crystals in 1 quart of water?

31.—What percentage would you get by adding 20 drams of Lysol to water enough to make 2 quarts.

32.—What percentage solution would you get by adding 52 drams of 5% Carbolic to water enough to make 2 quarts?

33.—From Formalin make 2 quarts of 1% solution.

34.—From tablets of Digitalin gr. $\frac{1}{50}$ give gr. $\frac{1}{60}$.

35.—From 80% Sodium Bromide solution, give 12 grains.

36.—If 5 drams of Oxalic Acid crystals are used to make 4 quarts of solution, what percentage will it be?

37.—Make 60 c.c. of Olive Oil ½% Carbolic.

38.—Make 3 ounces of Alcohol 5% Menthol.

39.—Make 1 quart of Glucose 4% and Sodium Bicarbonate 2%.

40.—Make 1 ounce of glycerine 10% Phenol.

Per cent			*Proportion*
1/10 of 1%	(.001)	equals	1-1000
1/5 of 1%	(.002)	"	1-500
½ of 1%	(.005)	"	1-200
1%	(.01)	"	1-100
2%	(.02)	"	1-50
2½%	(.025)	"	1-40
3%	(.03)	"	1-33 (3-100)
4%	(.04)	"	1-25
5%	(.05)	"	1-20
10%	(.10)	"	1-10
20%	(.20)	"	1-5
25%	(.25)	"	1-4
50%	(.50)	"	1-2
95%	"Pure Drug"	"	1-1
100%			

One Level Teaspoonful....Weighs	
Compound Licorice powder	30 gr.
Milk Sugar	48 "
Boric Acid (Crystals)	50 "
Boric Acid (Powder)	44 "
Borax	52 "
Sodium Bicarbonate	55 "
Magnesium Sulphate	79 "
Sodium Chloride	90 "
Cane Sugar	66 "
Bismuth Subnitrate	50 "
Powdered Alum (burnt)	44 "
Sulphur	40 "

ANSWERS TO PROBLEMS

Lesson I, p. 13.

4. $\frac{12}{15}$ **5.** $\frac{3}{8}$. **6.** $\frac{3}{16}$ plus a few drops of water. **7.** $\frac{6}{16}$ or $\frac{9}{24}$. **8.** $\frac{15}{20}$ 2 tablets. **9.** $\frac{10}{12}$ or $\frac{15}{18}$ 2 tablets. **10.** $\frac{8}{15}$ 2 tablets. **11.** $\frac{16}{20}$ 3 tablets.

Lesson II, p. 18.

1. 384. **2.** 4000. **3.** 960. **4.** 180. **5.** 600. **6.** 45. **7.** 192. **8.** 64 ounces, 512 drams, 2000 cubic centimeters. **9.** 450 grains or 7½ drams, or 480 grains, 8 drams. **10.** 250.

Lesson III, p. 25.

4. 637.5. **5.** 7.2 gm. **6.** 24 drams. **7.** 40 gm., 600 grains, 10 drams. **8.** Use 12.5 c.c. of creolin. **9.** 10 gm. **10.** 6.3 gm. in alcohol.

Lesson IV, p. 29.

4. 200 c.c. **5.** 1 drop plus 9 drops water. **6.** 40 drops. **7.** Equal parts. **8.** Equal parts.

Lesson V, p. 34.

4. 16 drops. **5.** 192 drops or 12 c.c. **6.** 62.5 c.c. **7.** 800 c.c. **8.** 24 drops. **9.** 12 c.c. **10.** 18.75 c.c., or 4.8 drams.

Lesson VI, p. 38.

3. .04, .03⅓, .003⅓, .0625.

Lesson VII, p. 42.

3. 1 c.c. **4.** 250 c.c. **5.** 25 c.c. **6.** 5 drops. **7.** 5 c.c. **8.** 50 c.c. **9.** 250 c.c. **10.** 40 c.c.

Lesson VIII, p. 45.

4. 20 drops. **5.** 80 drops. **6.** 40 drops. **7.** 15 drops. **8.** 20 c.c.

Lesson IX, p. 49.

4. 1 drop Tr. plus 7 drops water. **5.** 1 drop solution plus 1 drop water. **6.** 1 drop plus 4 drops water; give 1 drop.

Lesson X, p. 51.

1. 225 grains. **2.** .006. **3.** 1 qt. or 1000 c.c. **4.** 1.2 c.c., or 18 drops. **5.** 75 drops. **6.** .002. **7.** 5 c.c. **8.** 5 c.c. **9.** 500 c.c. **10.** 4000 c.c. **11.** 8000 c.c. **12.** 30 gm., 450 grains, 7½ drams. **13.** 20 c.c. **14.** 10,000 c.c. **15.** 1 tablet $\frac{10}{15}$. **16.** Dissolve two tablets in 20 drops and give 15 drops. **17.** 2 tablets $\frac{10}{15}$ **18.** 1200 c.c. **19.** 90 gm. **20.** 17+ c.c. **21.** 40 drops. **22.** 5 tablets. **23.** 50 c.c. **24.** 16 c.c. **25.** 8 c.c. **26.** 1 dram 25% plus 9 drams water. **27.** 100 c. c.of 5%. **28.** 2 drops

equal $\frac{1}{150}$ gr. **29.** 4 drops equal $\frac{1}{5}$ gr. **30.** .002. **31.** .04. **32.** .005+. **33.** Take 50 c.c. of formalin. **34.** $\frac{10}{12}$. **35.** Give 15 drops. **36.** .005. **37.** 0.3 c.c. or 4½ drops of pure carbolic in olive oil. **38.** 4.5 gm. menthol in alcohol. **39.** 40 gm. of glucose and 20 gm. of sodium bicarbonate in 1 quart water. **40.** 3 gm. phenol in 1 ounce glycerine.